PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 :		(11) International Publication Number:	WO 91/08175
C02F 1/24	A1	(43) International Publication Date:	13 June 1991 (13.06.91)

(21) International Application Number: PCT/DK90/00314

(22) International Filing Date: 3 December 1990 (03.12.90)

(30) Priority data:
6101/89 4 December 1989 (04.12.89) DK

(71) Applicant *(for all designated States except US)*: AKVAGAD A/S [DK/DK]; Agenavej 31-33, DK-2670 Greve Strand (DK).

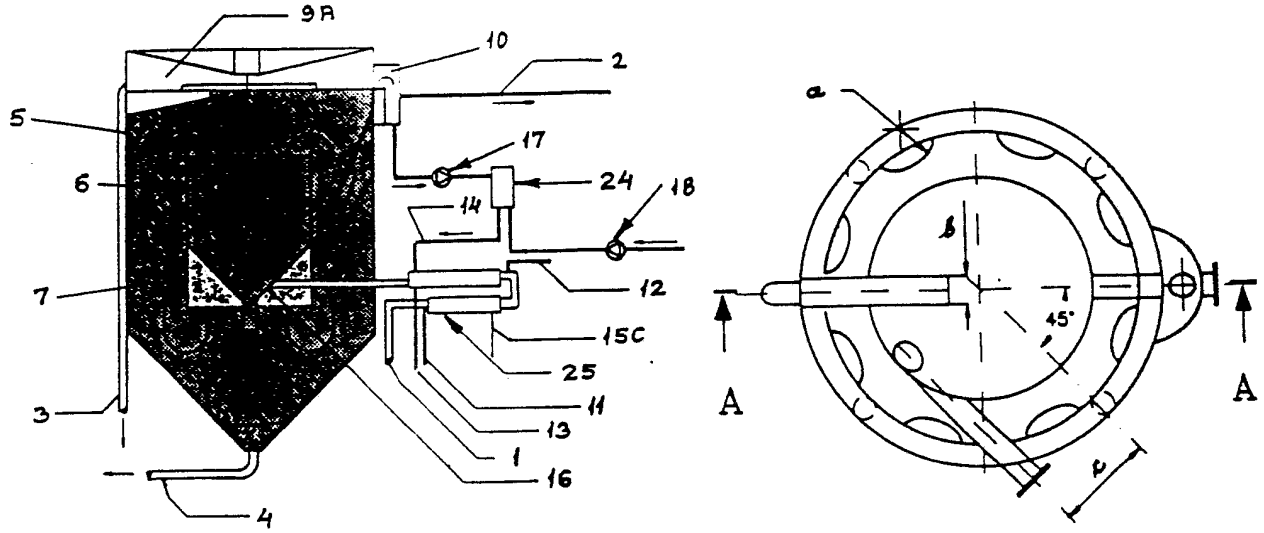
(72) Inventor; and
(75) Inventor/Applicant *(for US only)* : KARSTEN, Poulsen [DK/DK]; Dronningholmvej 8, DK-9600 Aars (DK).

(74) Agent: LARSEN & BIRKEHOLM A/S SKANDINAVISK PATENTBUREAU ; Skagensgade 64, DK-2630 Taastrup (DK).

(81) Designated States: AT, AT (European patent), AU, BB, BE (European patent), BF (OAPI patent), BG, BJ (OAPI patent), BR, CA, CF (OAPI patent), CG (OAPI patent), CH, CH (European patent), CM (OAPI patent), DE, DE (European patent), DK, DK (European patent), ES, ES (European patent), FI, FR (European patent), GA (OAPI patent), GB, GB (European patent), GR, GR (European patent), HU, IT (European patent), JP, KP, KR, LK, LU, LU (European patent), MC, MG, ML (OAPI patent), MR (OAPI patent), MW, NL, NL (European patent), NO, RO, SD, SE, SE (European patent), SN (OAPI patent), SU, TD (OAPI patent), TG (OAPI patent), US.

Published
With international search report.
In English translation (filed in Danish).

(54) Title: SEWAGE PURIFICATION METHOD USING FLOTATION AND APPARATUS FOR THE IMPLEMENTATION OF THE METHOD



(57) Abstract

An improved and simplified purification of waste water making use of flotation and an apparatus therefor are described. The waste water may contain suspended particles having a density (almost) as the density of water. The purified liquid is led away from a region below the liquid surface and above the lower sludge take-off, preferably centrally in the outer vessel (5), and not over a saw-toothed edge. The apparatus may contain an outer and an inner vessel (5 and 6) where the outer vessel (6) may contain a bell (7) open at the bottom with upward directed leading-away canals for purified liquid. Possible downward directed shells (8A, 8B) between the vessel (5 and 6) further the purification of the liquid. The leading-to line (1) may have been introduced tangentially on the inner vessel (6). In the leading-to line there may be found specially worked out devices (21, 22 and 23) for pretreatment of the waste water. The purification and the use of the apparatus result in (much) purer led-away liquid than up to now, also in case of suspended particles having a density (almost) as the density of water.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	**FI**	Finland	**ML**	Mali
AU	Australia	**FR**	France	**MN**	Mongolia
BB	Barbados	**GA**	Gabon	**MR**	Mauritania
BE	Belgium	**GB**	United Kingdom	**MW**	Malawi
BF	Burkina Faso	**GN**	Guinea	**NL**	Netherlands
BG	Bulgaria	**GR**	Greece	**NO**	Norway
BJ	Benin	**HU**	Hungary	**PL**	Poland
BR	Brazil	**IT**	Italy	**RO**	Romania
CA	Canada	**JP**	Japan	**SD**	Sudan
CF	Central African Republic	**KP**	Democratic People's Republic of Korea	**SE**	Sweden
CG	Congo			**SN**	Senegal
CH	Switzerland	**KR**	Republic of Korea	**SU**	Soviet Union
CI	Côte d'Ivoire	**LI**	Liechtenstein	**TD**	Chad
CM	Cameroon	**LK**	Sri Lanka	**TG**	Togo
DE	Germany	**LU**	Luxembourg	**US**	United States of America
DK	Denmark	**MC**	Monaco		
ES	Spain	**MG**	Madagascar		

SEWAGE PURIFICATION METHOD USING FLOTATION AND APPARATUS FOR THE IMPLEMENTATION OF THE METHOD.

The present invention relates to a method for the purification of waste water making use of flotation and an apparatus for carrying out this method.

The waste water being subjected to purification may practically be any kind of waste water, i. a. the types of waste water coming from the sources stated in the following paragraph.

Throughout recent years there has generally been an increasing need for purification of waste water and specifically of waste water especially from big plants of various kinds, such as waste water from industrial plants, including waste water from food industry plants, e. g. waste water from slaughterhouses and plants for treating or working up/or processing meat, especially because the owner or the owners of one or more such plants have been directed to pay increasing purification duties so that the owner or the owners of one or more such plants have found it more attractive to purify waste water from the plant in question or the plants in question.

Chemical precipitation is one of the methods often being used with advantage for treating e. g. industrial waste water of some origin whether or not it involves waste water having a content of heavy metal ions or organic substances, including proteins from the food industry.

After the chemical precipitation it may be appropriate to remove the precipitated material either by sedimentation or by flotation. The last mentioned method is attractive, in particular when the waste water is containing fats that increase the amount of flotatable material. Flotation is less space demanding than sedimentation because the time of stay can be reduced by a factor of 3-5 in comparison with sedimentation. When treating 100-200 m^3 of waste water an hour

a flotation plant will - because of the smaller vessel volume being a consequence of this reduced time of stay - furthermore be less expensive while sedimentation for treating 400 m^3 an hour or above will as a rule be less expensive than flotation.

There are known a number of different methods and the carrying out of these methods results in that a part of the suspended substance undergoes a sedimentation and that a part of the suspended substance undergoes a flotation by means of the air added as part of the carrying out of the flotation. The liquid that at least to a considerable extent has been purified with respect to suspended substance will leave the flotation plant by overflow via a saw-toothed edge.

By making use of such known methods it is possible to remove with a high efficiency particles having a density being great or small, possibly very great or small with respect to the density of water, these particles forming part of the suspended substance while there occurs an efficiency being at least inferior, often poor when making use of such flotation plants when removing suspended substance in which the particles have a density being close to, being approximately the same as or being the same as the density of water.

In addition there are known apparatuses for carrying out these known methods. These known apparatuses may have various cross sections, such as a rectangular cross section - this cross section being an example of a non-circular cross section - or a circular cross section. Beyond the other necessary members - being found in an apparatus, such as pipings, pumps and one or more devices for introducing air into the liquid as it is led to the apparatus these known apparatuses have been provided with a scraper for removing sludge settling on the surface of the liquid and they may be provided with a scraper for removing the sludge gathering on the bottom of the apparatus.

Therefore, the object of the present invention is to indicate (A) a method for the purification of waste water making use of flotation in which method not only a removal of particles having a density being great or small, possibly very great or small with respect to the density of water takes place with a high efficiency but also a removal of suspended substance in which the particles have a density being close to, being approximately the same as or being the same as the density of water takes place with an improved or high efficiency and (B) an apparatus for carrying out this method.

Part (A) of the indicated object of the present invention is achieved by a method, characterized in that there is performed a leading-away of the purified liquid from a region being situated below the surface of the liquid and above the lower sludge take-off, preferably centrally in the outer vessel.

The method of the present invention differs from the known methods for purification of waste water making use of flotation in the manner in which the purified liquid is being led away, viz. being led away without being in contact with or having been in contact with the sludge resulting from the flotation - which sludge seeks up to and settles on the surface of the liquid - in contradistinction to the taking-off of purified liquid in contact with the sludge resulting from the flotation - which sludge as mentioned seeks up to and settles on the surface of the liquid - in carrying out the known methods for purification of waste water making use of flotation.

By taking off the purified liquid in this manner there is achieved (I) that the whole surface of the contents of the apparatus used - this surface being below the flotated sludge - is being utilized for removing this flotated sludge, also called top sludge, (II) that one avoids the problems being connected to the operation of a known apparatus containing a saw-toothed edge for overflow of purified liquid, this avoidance constituting a simplification in the carrying-out of the

method of the present invention with respect to the carrying-out of the known methods, which simplification results in a saving, possibly a major saving in the expenses of operation, (III) that the purified liquid during its taking-off does not get into contact with the flotating stream - out of which flotating stream the top sludge comes - nor into contact with the sedimentating stream out of which stream the sludge at the bottom of the apparatus comes, this sludge at bottom of the apparatus being the so called bottom sludge, and (IV) that the taken-off liquid as a consequence of what has been stated under the just preceding item (III) has a relatively low concentration of suspended material which is tantamount to an improved or high efficiency of the separation of suspended material from the liquid.

When carrying out the method of the present invention the suspended particles are separated in a rising stream and a descending stream corresponding to particles having a density being less than, respectively greater than the density of water. The stream of liquid will preferably rise and therefore the particles having the same density as the density of water will also flotate during the carrying-out of the method of the present invention because there is no take-off for the purified liquid at the surface of the liquid contents of the apparatus being used in carrying out the method. A result of this is that in general by means of the method of the present invention there is achieved a better removal of suspended substance which result of this preferably applies to a liquid in which there are suspended particles having approximately the same density as the density of water.

Part (B) of the indicated object of the present invention is achieved by an apparatus, characterized in that it contains means for leading-away of liquid from the central region of the outer vessel.

The apparatus of the present invention differs from the known

apparatuses for carrying out methods of purification of waste water making use of flotation by the placing of the take-off for the purified liquid. The placing of the take-off has the result that in contradistinction to the taking-off of purified water in the known apparatuses it is avoided to take off the purified water at the top of the flotation plant.

By this placing of the take-off for the purified liquid there is achieved (I) that the whole surface of the contents of the apparatus of the present invention - this surface being below the flotated sludge - may be utilized for removing this flotated sludge, also called top sludge, (II) that one avoids the saw-toothed edge for overflow of purified water which simplification in the structure of the apparatus of the present invention as compared to the structure of the known apparatuses results in a fairly big saving in the expenses of building, (III) that the purified liquid during its taking-off does not get into contact with the flotating stream - out of which flotating stream the top sludge comes - nor into contact with the sedimentating stream out of which stream the sludge at the bottom of the apparatus comes, this sludge at bottom of the apparatus being the so called bottom sludge, and (IV) that the taken-off liquid as a consequence of what has been stated under the just preceding item (III) has a relatively low concentration of suspended material, which is tantamount to an improved or high efficiency of the separation of suspended material from the liquid.

In the apparatus of the present invention the particles of the suspended substances or, if you like, the suspended particles are separated by the leading-away means in a rising stream and a descending stream corresponding to particles having a density being less than, respectively greater than the density of water. Owing to the shape of these means the stream of liquid will preferably rise and therefore the particles having the same density as the density of water will also flotate in the apparatus of the present invention because there is no take-

off for the purified liquid at the surface of the liquid contents of the apparatus. A result of this is that in general by means of the use of the apparatus of the present invention there is achieved a better removal of suspended substance which result of this preferably applies to a liquid in which there are suspended particles having approximately the same density as the density of water.

It is advantagous in connection with the apparatus of the present invention which apparatus contains an outer vessel and an inner vessel which vessels each are made up of a top part and a bottom part, this bottom part of the outer and/or inner vessel possibly being tapered, a leading-to line - possibly containing one or more treatment devices -for waste water, one or more devices for leading-away of purified liquid, a sludge scraper in the upper part of the apparatus, a line for leading-away of sludge from the upper part of the apparatus, a line for leading-away of sludge from the lower part of the apparatus:

(a) that it contains a collecting device for purified liquid which collecting device for purified liquid begins at the transition from the top part of inner vessel to the bottom part of the inner vessel which collecting device extends away from the transition from the top part of the inner vessel to the bottom part of the inner vessel and the wall of which collecting device ends in a boundary, including an edge, bounding an opening through which there is access to the interior of the collecting device,

(b) the device or the devices for leading-away of purified liquid issue from the upper part of the space in the collecting device for purified liquid which device or which devices for leading-away of purified liquid end in one or more level control devices which device or which devices for level control are placed at a level above the boundary in which the collecting device ends, preferably

above the level of the beginning of the collecting device,

(c) that the wall of the collecting device has a non-circular cross section, this non-circular cross section possibly being wholly or partly a polygonal cross section or being a circular cross section,

(d) that one or more lines being situated within the collecting wall and also in a plane containing the line in the middle or the centre line of the apparatus which line or which lines within the wall of the collecting device may form an angle differing from 0° with the line in the middle or centre line of the apparatus, the plane of the cross section being perpendicular to the line in the middle or the centre line of the apparatus, the wall of the collecting device having a cross section being preferably the cross section of a body having a symmetry of rotation around the centre line of the apparatus, this cross section possibly being the cross section of a cylinder or of a truncated cone the lower terminal surface or base of which is greater, respectively smaller than its upper terminal surface, the edge of which upper terminal surface constitutes the beginning of the wall of the collecting device,

(e) that the wall of the top part and/or bottom part of the inner vessel has a non-circular cross section, this non-circular cross section possibly being wholly or partly a polygonal cross section or being a circular cross section,

(f) that one or more lines being situated within the wall of the top part and/or bottom part of the inner vessel and also in a plane containing the line in the middle or the centre line of the apparatus which line or which lines within the wall of the top part and/or bottom part of the inner vessel may form an angle differing from 0° with the line in the middle or centre line of the apparatus, the

plane of the cross section being perpendicular to the line in the middle or the centre line of the apparatus,

(g) that the bottom of the inner vessel has been provided with an outflow device,

(h) that the wall of the top part and/or bottom part of the outer vessel has a non-circular cross section, this non-circular cross section possibly being wholly or partly a polygonal cross section or being a circular cross section,

(i) that one or more lines being situated within the wall of the top part and/or bottom part of the outer vessel and also in a plane containing the line in the middle or the centre line of the apparatus which line or which lines within the wall of the top part and/or bottom part of the outer vessel may form an angle differing from 0° with the line in the middle or centre line of the apparatus, the plane of the cross section being perpendicular to the line in the middle or the centre line of the apparatus,

such a structure of an apparatus of such members - these members being worked out in such ways - giving an apparatus having such qualities of use that - by using such an apparatus when carrying out the method of the present invention - a good carrying-through of the method is achieved.

As a supplement to what has been stated in the just preceding paragraph reference is made to the below given mention of what has been illustrated in fig. 1A.

It is also advantagous in connection with the apparatus of the present invention that the leading-to line for waste water has been introduced tangentially on the inner vessel since hereby a good control of the flow conditions is achieved within the inner vessel of the apparatus of the present invention.

Moreover, it is advantagous in connection with an apparatus of the present invention that on the inner vessel and facing the outer vessel there have been placed one or more preferably downward directed shells as such shells contribute to the establishment of such flow conditions in the liquid - being treated within the apparatus of the present invention during the carrying-out of the method of the present invention - that make it more difficult for parts of the suspended particles to reach the take-off for purified liquid. The result of this is at least a slightly increased efficiency of the purification of waste water carried through by carrying out the method of the present invention.

As a supplement to what has been stated in the just preceding paragraph reference is made to the below given mention of what has been illustrated in fig. 3.

Besides it is advantagous in connection with the apparatus of the present invention:

(a) that the shell angle being formed (I) by a line being situated within the shell and also being situated in a plane containing the line in the middle or the centre line of the apparatus and (II) by the line in the middle or the centre line of the apparatus is situated within the interval 30-80°, that it is preferred that the shell angle is situated within the interval 40-70° and more preferred that the shell angle is situated within the interval 50-60°, or that the shell angle has the value of 60°, and/or

(b) that the width of the shell measured from the boundary of the shell, in particular from the edge of the shell, to the wall of the outer or inner vessel in a plane being perpendicular to the line in the middle or the centre line of the apparatus and along a line - the measuring line - being perpendicular to the line in the middle or the centre line of the apparatus makes up 60-100%, that is

preferred that its width makes up 60-90%, more preferred that its width makes up 60-80%, and most preferred that its width makes up 60-70% of the distance between the inner wall of the outer vessel and the inner vessel wall facing the outer vessel - the vessel distance - that the shell when its width as defined here makes up 100% of the vessel distance has been provided with holes the function of which is to let water pass the shell, and that the shell when its width as defined here makes up 60% and up to 100% of the vessel distance has been provided with or may have been provided with holes the function of which is to let water pass the shell,

such shell angles and/or such shell widths contributing to the establishment of such flow conditions in the liquid - being treated within the apparatus of the present invention during the carrying-out of the method of the present invention - that make it more difficult for parts of the suspended particles to reach the take-off for purified liquid. The result of this is at least a slightly increased efficiency of the purification of waste water carried through by carrying out the method of the present invention.

Besides experience has taught that it is possible by means of investigations - being performed in detail and with care - of a number of conditions being connected with the use of the apparatus of the present invention when carrying of the method of the present invention to arrive at an apparatus of the present invention being provided with one or more shells the structure of which is such that one is at least on the way to, possibly well on the way to providing an apparatus the use of which helps to condition a result of the carrying-through of the purification of waste water by carrying-out of the method of the present invention for purification of waste water making use of flotation, this result being at least little short of an optimal result.

In addition to that it is advantagous in connection with the apparatus of the present invention which apparatus contains a treatment device in the leading-to line for waste water that this treatment device is a device for mixing a precipitant into the waste water as it has been found that the use of an apparatus of the present invention having a device for mixing precipitant into the waste water stream and not just having a device for introducing precipitant into the waste water stream leads to an improved result of the carrying-through of the purification of waste water when carrying out the method of the present invention for purification of waste water making use of flotation.

As a supplement to what has been stated in the just preceding paragraph reference is made to the below given mention of what has been illustrated in fig. 4.

Further, it is advantagous in connection with the apparatus of the present invention which apparatus contains a treatment device in the leading-to line for waste water that this treatment device is a device for mixing a pH adjusting agent into the waste water, such as a device for mixing of an alkaline material, such as lye, because by using such an apparatus when carrying through the purification of waste water when carrying out the method of the present invention for purification of waste water making use of flotation one gets a possibilty - in an appropriate manner - of adjusting the pH value of the liquid, including the pH value of the taken-off purified liquid, which last mentioned pH value has to be situated within a definite interval indicated hereinbelow when leading out into a recipient, such as a stream or a lake, possibly via sewerage system.

Moreover, it is advantagous in connection with the apparatus of the present invention which apparatus contains a treatment device in the leading-to line for waste water that this treatment device is a device for mixing pressurized water with a

flocculating agent and for mixing the mixture of pressurized water and flocculating agent into the waste water as it has been found the the use of an apparatus of the present invention having a device for mixing pressurized water with a flocculating agent and for mixing the mixture of pressurized water and flocculating agent into the waste water stream leads to an improved result of the carrying-through of the purification of waste water when carrying out the method of the present invention for purification of waste water making use of flotation. Introducing the flocculating agent into the waste water stream - also called the main water stream - in the manner just indicated here may in typical cases with respect to introducing the flocculating agent in waste water stream before or after introducing the pressurized water into the waste water stream result in an increased reduction of COD (from: Chemical Oxygen Demand) amounting to 40-80 mg/l. This increased reduction or, if you like, increased efficiency is an unexpected increase and as a consequence a surprising increase.

As a supplement to what has been stated in the just preceding paragraph reference is made to the below given mention of what has been illustrated in fig. 5.

It is also advantagous in connection with the apparatus of the present invention which apparatus in the leading-to line for the waste water contains two treatment devices:

(a) that the first treatment device in the direction of flow of the waste water is a device for mixing a precipitant into the waste water and

(b) that the second treatment device in the direction of flow of the waste water is a device for mixing pressurized water with a flocculating agent and for mixing the mixture of pressurized water and flocculating agent into the waste water

as it has been found in practice that the use of an apparatus of the present invention having the two just indicated treatment devices in the just indicated order of succession leads to an improved result of the carrying-through of the purification of waste water by carrying out the method of the present for purification of waste water making use of flotation.

As a supplement to what has been stated in the just preceding paragraph reference is made to the below given mention of what has been illustrated in fig. 1B-1D and 3-5, in particular what has been illustrated in fig. 1B-1D and 3.

It is advantagous as well in connection with the apparatus of the present invention which apparatus in the leading-to line for the waste water contains three treatment devices:

(a) that the first treatment device in the direction of flow of the waste water is a device for mixing a precipitant into the waste water,

(b) that the second treatment device in the direction of flow of the waste water is a device for mixing a pH adjusting agent into the waste water, preferably a device for mixing an alkaline material, such as lye, and

(c) that the third treatment device in the direction of flow of the waste water is a device for mixing pressurized water with a flocculating agent and for mixing the mixture of pressurized water and flocculating agent into the waste water,

as it has been found in practice that the use of an apparatus of the present invention having the three just indicated treatment devices in the just indicated order of succession leads to an improved result of the carrying-

through of the purification of waste water by carrying out the method of the present for purification of waste water making use of flotation.

As a supplement to what has been stated in the just preceding paragraph reference is made to the below given mention of what has been illustrated in fig. 1B-1D and 3-5, in particular what has been illustrated in fig. 1B-1D and 3.

In connection with what has been stated in the nine just preceding paragraphs it is pointed out that the course of the mixing of waste water, pressurized water and chemicals - which on the whole means precipitants, pH adjusting agents and flocculating agents - is of decisive importance and as a consequence very important to the course and the result of the precipitation being performed at least immediately before the very flotation apparatus - i. e. the apparatus constituted of the apparatus of the present invention as defined in the claims for carrying out the method of the present invention exclusive of leading-to lines and leading-away lines having the treatment devices that might occur in each of the two or both of the mentioned types of lines, these lines occurring outside the outer vessel. The reason for this is the faster and the better this mixing goes off, the better will be the course and the result of the precipitation, and as a consequence the achieved efficiency of the performed purification the waste water. Likewise it is also important to add the flocculating agent after the precipitant, especially the proper precipitant, so that flocculating agent gets a chance to act on the flocs already formed.

In connection with what has been stated in the nine just preceding paragraphs it is furthermore pointed out that the mention given below of what has been illustrated in fig. 1B (and as a consequence also in fig. 3) contains a mention of a waste water leading-to line of which such treatment devices for carrying out a definite method for adding chemicals and for mix-

ing these substances into a liquid, viz. waste water, which definite method is a method by means of which there is guaranteed an optimal addition and mixing form part. In this method there is first added a a precipitant, then perhaps a pH adjusting agent and next a flocculating agent.

In carrying out the method of the present invention, respectively the use of the apparatus of the present invention there may be used one or more precipitants selected among the following precipitants indicated as examples:

Aluminium sulphate, ferric chloride, calcium hydroxide, hydrogen sulphide, xanthates, sodium hydroxide, bentonite, kaoline, starch, polyacylamide(s), lignin sulphonic acid, dodecylbenzensulphonic acid, and glucose trisulphate.

In carrying out the method of the present invention, respectively the use of the apparatus of the present invention there may be used one or more precipitants that typically are being dosed in concentrations selected among the following, as examples indicated concentrations: 40-2,000 mg/l, especially 10-1,000 mg/l.

In carrying out the method of the present invention, respectively the use of the apparatus of the present invention there may be used one or more flocculating agents, also called flocculants, selected among the following flocculating agents indicated as examples:

(a) Natural flocculating agents: Clay, starch, and gelatine, and

(b) artificial or synthetic flocculating agents, also called polyflocculants: Cationic polyelectrolytes, such as polydiallyldimethylammonium, anionic polyelectrolytes, such as polyacrylic acid, non-ionic polymers, such as polyacylamide(s), and polyethylenoxide.

In carrying out the method of the present invention, respectively the use of the apparatus of the present invention there may be used one or more flocculating agents that typically are being dosed in concentrations selected among the following concentrations indicated as examples: 0.4-20 mg/l, especially 1-10 mg/l.

In carrying out the method of the present invention, respectively the use of the apparatus of the present invention it may occur that one or more pH adjusting agents are being used, e. g. an alkaline material, such as lye, that are typically being dosed in concentrations being selected in such a way that the pH value of the water being led out is situated within the interval within which the pH value has to be situated in a number of countries, i. a. DK, viz: 6-8.

The pH value of the waste water to be purified may be situated in the interval 4-9.

The invention will be explained in some detail below having reference to the drawing as well as an example of comparison and three examples of embodiment. It should be noted that the embodiments of the apparatus of the present invention shown in the drawing and the forms of carrying out the method of the present invention illustrated in the examples of embodiment are given solely as examples and should in no way be considered as limiting the invention in one or more respects.

In the drawing

fig. 1A shows an apparatus of the present invention having no shell between the outer vessel and the inner vessel but having a leading-to line for waste water of which leading-to line treatment devices indicated below in some detail form part, having a leading-away line for purified liquid, having a leading-away

line for top sludge, and having a leading-away line for bottom sludge; the part of the apparatus - being made up of the outer vessel and the inner vessel, the collecting device with leading-away line and level controller for purified liquid and the scraper for top sludge - being shown in a section along a plane containing the centre line of the outer vessel and being situated in the plane of the drawing,

fig. 1B shows the same as fig. 1A but with other treatment devices indicated below in some detail which treatment devices form part of the leading-to line for waste water and with the motor of the scraper for top sludge shown as a symbol of this scraper in its entirety,

fig. 1C shows a view seen from above of the vessel part of the apparatus with scraper, this apparatus being shown in fig. 1A,

fig. 1D shows an enlarged view - as far as the greater part is concerned in a section - of the mixing chamber forming part of the waste water leading-to line forming part of the apparatus shown in fig. 1A,

fig. 2 shows the vessel part of the apparatus seen from above (a scraper has been removed),

fig. 3 shows the same as fig. 1B but having a downward directed shell on the inner vessel in the space between the outer vessel and the inner vessel,

fig. 4 shows a device for mixing precipitant into waste water which device may form part of the leading-to line for waste water, this leading-to line being shown in fig. 1B, 2, and 3,

fig. 5 shows a device for mixing pressurized water with a flocculating agent and for mixing the mixture of pressurized water and flocculating agent into the waste water,

fig. 6 shows a device for producing pressurized water, and

fig. 7 shows the section A-A marked in fig. 2.

In fig. 1A there is shown an apparatus of the present invention of which an outer vessel 5, an inner vessel 6 having an outflow device at the bottom and a collecting device 7 for purified liquid with pertaining leading-away lines for purified liquid up to a level controller 10 - the collecting device 7 being connected to the inner vessel 6 - form part. To these parts of the apparatus of the present invention there is connected a line 1 for leading-to of waste water, this line 1 having a tangential introduction 16 on the inner vessel 6, a line 2 for leading-away of purified liquid, a line 3 for leading-away of top sludge, a line 4 for leading-away of bottom sludge. Of the apparatus of the present invention a scraper 9A for top sludge also forms part. The line 1 for leading-to of waste water includes a mixing chamber 25 - being shown as far as the greater part is concerned in a section and on an enlarged scale in fig. 1D - into which mixing chamber there has been introduced a pH sensor 15C. To this mixing chamber lead a line 11 for leading-to of precipitant, a line 12 for leading-to of a pH adjusting agent, a line 13 for leading-to of flocculating agent, and a line 14 for leading-to of pressurized water having a pressure of 6-9 atmospheres (cfr. fig. 6) which pressurized water comes from a device 24 for producing pressurized water. To the device 24 for producing pressurized water leads in part a line from a pump 17 being supplied with purified liquid from the level controller 10, in part a line for air under pressure from a pump 18.

When the apparatus illustrated in fig 1A is in use the su-

spended particles are separated i. a. by the collecting device 7 and leading-away lines connected to this device into a rising stream and a descending stream corresponding to particles having a density being less than, respectively greater than the density of water. Owing to the shape of the collecting device 7 the stream of liquid will preferably rise and therefore the particles having the same density as the density of water will also flotate in the apparatus of the present invention because there is no take-off for the purified liquid at the surface of the liquid contents of the apparatus. A result of this is that in general there is achieved a better removal of suspended substance which result of this preferably applies to a liquid in which there are suspended particles having approximately the same density as the density of water.

The effect of the presence of the collecting device 7 with pertaining leading-away lines to the level controller 10 has been established below in example 1.

In fig. 1B the apparatus of the present invention has the same structure as in fig. 1A though other treatment devices form part of the waste water leading-to line 1 in the apparatus illustrated in fig. 1B than in the apparatus illustrated in fig. 1A. Of the waste water leading-to line 1 in the apparatus of the present invention illustrated in fig. 1B a device 21 for mixing precipitant into the waste water which device has been illustrated in fig. 4, a device 22 for mixing a pH adjusting agent into the waste water, and a device 23 for mixing pressurized water with a flocculating agent and for mixing the mixture of pressurized water and flocculating agent into the waste water which device has been illustrated in fig. 5 form part.

In fig. 1B the numeral 9B is the motor in the scraper for the top sludge while 1, 2, 3, 4, 5, 7, 10, 13, and 14 refer to the same items as in fig. 1A.

In fig. 1C the vessel part of the apparatus with scraper shown in fig. 1A is seen from above.

In fig. 1D the mixing chamber 25 forming part of the waste water leading-to line 1 in the apparatus illustrated in fig. 1A is shown as far as the greater part is concerned in a section and in an enlarged version. In fig. 1D the numerals 1, 11, 12, 13, and 14 refer to the same items as in fig. 1A while 15A and 15B are sample take-offs.

In fig. 2 A-A indicates a section that has been shown in fig. 7. In fig. 2 a is the radius of a circle determining a part of the boundary of the openings shown. This radius is typically 200 mm. b is the width of an overflow canal. b is typically 200 mm. c is the distance between 1's centre line and the axis of symmetry of the vessel part of the apparatus. c is typically 575 mm.

The effect of introducing a shell on a wall facing the space between the outer vessel 5 and the inner vessel 6 has been established below in example 2.

In fig. 3 the apparatus of the present invention has the same structure as the apparatus of the present invention in fig. 1B though further a downward directed shell 8B on the inner vessel and facing the space between the outer vessel and the inner vessel forms part of the apparatus of the present invention illustrated in fig. 3. The other designations of reference in fig. 3 refer to the same items as in fig. 1B.

The effect of introducing a shell on the wall facing the space between the outer vessel 5 and the inner vessel 6 has been established below in example 2.

In fig. 4 a device for mixing a precipitant into waste water is shown which device may form part of the leading-to line for waste water shown in fig. 1B, 2, and 3. In fig. 4 the numeral

19 is the end part of a pipe for leading-to of precipitant which pipe end part has been provided with holes for the passage of the precipitant out into the waste water. It is pointed out that the size of the holes 19 is dependent on the placing of the end part 19 in the stream. In fig. 4 is water a short designation for waste water.

It should be noted that the device shown in fig. 4 for the mixing of precipitant into waste water may also form part of other apparatuses than the apparatus of the present invention.

In fig. 5 there is shown a device for mixing pressurized water with a flocculating agent and for mixing the mixture of pressurized water and flocculating agent into the waste water which device may form part of the leading-to line for waste water shown in fig. 1B, 2, and 3. In fig. 5 the numeral 20 is a device for pressure adjustment. In fig. 5 main water stream is a short designation for main waste water stream.

The effect of the use of the device shown in fig. 5 has been established in example 3.

It should be noted that the device shown in fig. 5 for mixing of pressurized water with a flocculating agent and for mixing the mixture of pressurized water and flocculating agent into the waste water may also form part of other apparatuses than the apparatus of the present invention.

In fig. 6 there is shown a device for producing pressurized water, confer 24 in fig. 1A. In fig. 6 the numeral 14 refers to the same items as in fig.s 1A to 3.

In the section A-A shown in fig. 7 the diameter of the vessel is typically 2,400 mm while the other measures in this section are fixed by the proportions of the figure.

In the following

the example of comparison illustrates a method for purification of waste water making use of flotation carried out making use of a miniapparatus for the imitation of an apparatus in full scale having a known overflow and illustrates as a consequence an imitation of what a known plant can cope with,

example 1 illustrates a method for purification of waste water making use of flotation carried out making use of an apparatus of the present invention having no shell in the space between the outer vessel 5 and the inner vessel 6, viz. an apparatus of the present invention of the type being illustrated in fig. 1A - i. e. having no device 23 for mixing pressurized water with a flocculating agent and for mixing the mixture of pressurized water and flocculating agent into the waste water - and in fig. 1B but having no device 23 for mixing of pressurized water with a flocculating agent and for mixing the mixture of pressurized water and flocculating agent into the waste water,

example 2 illustrates a method for purification of waste water making use of flotation carried out making use of an apparatus of the present invention having no shell, respectively having a shell in the space between the outer vessel and the inner vessel, viz.

an apparatus of the present invention of the type being illustrated in fig. 1B but having no device 23 for mixing pressurized water with a flocculating agent and for mixing the mixture of pressurized water and flocculating agent into the waste water, respectively

an apparatus of the present invention of the type illustrated in fig. 2, respectively fig. 3 but hav-

ing no device 23 for mixing pressurized water with a flocculating agent and for mixing the mixture of pressurized water and flocculating agent into the waste water, and

example 3 illustrates a method for purification of waste water making use of flotation carried out making use of an apparatus of the present invention having a shell in the space between the outer vessel 5 and the inner vessel 6 and having a device 23 for mixing pressurized water with a flocculating agent and for mixing the mixture of pressurized water and flocculating agent into the waste water, i. e. an apparatus of the present invention of the type illustrated in fig. 2 and fig. 3 respectively.

Example of comparison

In the laboratory 1 litre of slaughterhouse waste water is precipitated by adding 2 ml of a ferric chloride solution (30%) and 1 ml of a 0,5% solution of a cationic polyflocculant based on polyacrylic acid. It was investigated how great a part of the suspended substance sinks to the bottom and can flotate by adding 100 ml of water having been subjected to a pressure of 8 atmospheres.

By analysis it was found that 0.54 g suspended substance had sunken to the bottom and that 1.28 flotated. It was found that 0.12 g/l of the suspended substance neither flotated nor sank to the bottom.

From these results you find that it is important to avoid that these 0.12 g/l find their way out of the apparatus together with the purified water.

By analysis it is found that these 0.12 g/l correspond to a COD of 160 mg/l which becomes the increased degree of purifi-

cation that can be achieved by having this part of the suspended substance removed from the water, see example 2, last paragraph.

Example 1

In connection with a flotation plant in which there are treated 50 m^3/h slaughterhouse waste water of the same type as the slaughterhouse waste water that was investigated in the example of comparison it was found the treated water contains 0.05 g/l of suspended substance and therefore less than the 0.12 g/l that might be expected if the flotation plant were of the common type with taking-off of the purified liquid over an overflow.

By directly assuming the COD and the suspended substance to be proportional it can be calculated that the 0.05 g/l of suspended substance correspond to a COD of 66 mg/l while it should be expected that there were 160 mg/l of suspended material after the plant.

Example 2

In the plant that was used in example 1, i. e. a plant having no shell in the space between the outer vessel 5 and the inner vessel 6, and in a plant having a shell - viz. a plant as the plant being shown in fig. 2 or in fig. 3 which plant was provided by having installed a shell - like the shell shown in fig. 2 or fig. 3 - into the plant that was used during the operation during which operation the first results indicated in this example were obtained with the plant having no shell - operation has been performed for a longer period of time.

By the use of the plant having no shell the following results were obtained:

(average of 8 analyses)
(the standard deviation has been indicated for the average)

COD before the plant	2,340 mg/l +/- 30 mg/l
COD after the plant	790 mg/l +/- 45 mg/l

By the use of the plant having a shell the following results were obtained:

(average of 11 analyses)
(the standard deviation has been indicated for the average)

COD before the plant	2,410 mg/l +/- 20 mg/l
COD after the plant	710 mg/l +/- 25 mg/l

Without a shell there is obtained a removal of COD of

1,550 mg/l +/- 54 mg/l

With a shell there is obtained a removal of COD of

1,700 mg/l +/- 32 mg/l

It is seen that the difference between the two cases is significant which means that it may be presumed that the presence of the shell gave an increase of the efficiency corresponding to a COD of 160 mg/l, see the example of comparison, last paragraph.

Example 3

In the plant used in example 2 a precipitation was performed by adding chemicals to the main water stream, also called the waste water stream. The experiment was run for 8 hours and hourly samples were taken off before and after which hourly

samples were analysed with respect to COD. The average of the analyses of the water before and after the plant showed that the COD was reduced from 2,390 to 760 mg/l or a total COD of 1,630 mg/l+/- 20 mg/l. By comparing with the 1,700 mg/l in example 2 it is seen that there is obtained an improvement of 70 mg/l by using the above stated technique of dosage, viz. dosing making use of the device shown in fig. 5 above, as compared to example 2, wherein the technique of dosage just indicated here was not used. As the uncertainty of this difference is approximately 35 mg/l it can be established that the difference is only just significant by requiring that the difference has to be two or more times greater than the standard deviation of the standard difference.

What has been indicated in the specification in a concrete or specific way relating to the present invention is given as examples only and should in no way be considered as limiting - in one or more respects - the scope of the present invention which scope is laid down solely by the appended claims as many a modification, change or replacement may be made without passing the limits of the scope of the present invention wholly or partly or without departing from the spirit or the idea of the present invention wholly or partly.

C L A I M S

1. A method for purification of waste water making use of flotation in which method waste water is led through a piping into an inner vessel of an apparatus of which an inner vessel and an outer vessel form part and in which method there is performed a leading-away of the purified liquid from a region being situated beloe the surface of the liquid and above a lower sludge take-off in the outer vessel, c h a r a c t e r i z e d i n

(a) that the liquid is led out above by passage of the upper edge of the inner vessel, this upper edge being situated under the upper edge of the outer vessel,

(b) that the liquid is next led on downwards through the space between the outer vessel and the inner vessel, and

(c) that the liquid is finally led away from a position under the inner vessel.

2. An apparatus for carrying out the method according to claim 1 having an inner vessel and an outer vessel and having means for leading liquid into the inner vessel and finally means for leading-away of the purified liquid from a region being situated under the surface of the liquid and above a lower sludge take-off, c h a r a c t e r i z e d i n that the vessels are similar and cylindrical with concentric vertical axes, that the inner vessel has been worked out with a downward projecting shell, and that the means for leading-away are connected with the space under the inner vessel, this space having been formed by this shell.

3. An apparatus according to claim 2, c h a r a c t e r i z e d i n that the inner vessel at the bottom has been worked out as a downward tapering cone having an opening being situated above the lower sludge take-off.

4. An apparatus according to claims 2 or 3, c h a r a c - t e r i z e d i n that the leading-to line (8) for waste water has been introduced tangentially (16) on the inner vessel (6).

5. An apparatus for carrying out the method according to claims 2, 3, or 4, c h a r a c t e r i z e d i n

(a) that it contains a collecting device (7) for purified liquid which collecting device (7) for purified liquid begins at the transition from the top part of inner vessel (6) to the bottom part of the inner vessel (6) which collecting device (7) extends away from the transition from the top part of the inner vessel (6) to the bottom part of the inner vessel (6) and the wall of which collecting device (7) ends in a boundary, including an edge, bounding an opening through which there is access to the interior of the collecting device (7),

(b) that the device or the devices for leading-away of purified liquid issue from the upper part of the space in the collecting device (7) for purified liquid which device or which devices for leading-away of purified liquid end in one or more level control devices (10) which device or which devices for level control (10) are placed at a level above the boundary in which the collecting device (7) ends, preferably above the level of the beginning of the collecting device (7),

(c) that the wall of the collecting device (7) has a non-circular cross section, this non-circular cross section possibly being wholly or partly a polygonal cross section or being a circular cross section,

(d) that one or more lines being situated within the wall of the collecting device (7) and also in a plane containing

the line in the middle or the centre line of the apparatus which line or which lines within the wall of the collecting device (7) may form an angle differing from 0° with the line in the middle or centre line of the apparatus, the plane of the cross section being perpendicular to the line in the middle or the centre line of the apparatus, the wall of the collecting device (7) having a cross section being preferably the cross section of a body having a symmetry of rotation around the centre line of the apparatus, this cross section possibly being the cross section of a cylinder or of a truncated cone, the lower terminal surface or base of which is greater, respectively smaller than its upper terminal surface, the edge of which upper terminal surface constitutes the beginning of the wall of the collecting device (7),

(e) that the wall of the top part and/or bottom part of the inner vessel (6) has a non-circular cross section, this non-circular cross section possibly being wholly or partly a polygonal cross section or being a circular cross section,

(f) that one or more lines being situated within the wall of the top part and/or bottom part of the inner vessel (6) and also in a plane containing the line in the middle or the centre line of the apparatus which line or which lines within the wall of the top part and/or bottom part of the inner vessel (6) may form an angle differing from 0° with the line in the middle or centre line of the apparatus, the plane of the cross section being perpendicular to the line in the middle or the centre line of the apparatus,

(g) that the bottom of the inner vessel (6) has been provided with an outflow device,

(h) that the wall of the top part and/or bottom part of the outer vessel (5) has a non-circular cross section, this

non-circular cross section possibly being wholly or partly a polygonal cross section or being a circular cross section,

(i) that one or more lines being situated within the wall of the top part and/or bottom part of the outer vessel (5) and also in a plane containing the line in the middle or the centre line of the apparatus which line or which lines within the wall of the top part and/or bottom part of the outer vessel (5) may form an angle differing from 0° with the line in the middle or centre line of the apparatus, the plane of the cross section being perpendicular to the line in the middle or the centre line of the apparatus.

6. An apparatus according to one of the claims 2-5 having an inner vessel, c h a r a c t e r i z e d i n that on the inner vessel (6) and facing the outer vessel (5) and/or in the outer vessel (5) and facing the inner vessel (6) there are placed one or more preferably downward directed shells (8A, 8B).

7. An apparatus according to claim 6, c h a r a c t e - r i z e d i n

(a) that the shell angle being formed (I) by a line being situated within the shell (8A, 8B) and also being situated in a plane containing the line in the middle or the centre line of the apparatus and (II) by the line in the middle or the centre line of the apparatus is situated within the interval 30-80°, that it is preferred that the shell angle is situated within the interval 40-70° and more preferred that the shell angle is situated within the interval 50-60°, or that shell angle has the value of 60°, and/or

(b) that the width of the shell (8A, 8B) measured from the boundary of the shell, in particular from the edge of the shell (8A, 8B), to the wall of the outer or inner vessel (5 or 6) in a plane being perpendicular to the line in the

middle or the centre line of the apparatus and along a line - the measuring line - being perpendicular to the line in the middle or the centre line of the apparatus makes up 60-100%, that is preferred that its width makes up 60-90%, more preferred that its width makes up 60-80%, and most preferred that its width makes up 60-70% of the distance between the inner wall of the outer vessel (5) and the wall of the inner vessel (6) facing the outer vessel (5) - the vessel distance - that the shell (8A, 8B) when its width as defined here makes up 100% of the vessel distance has been provided with holes the function of which is to let water pass the shell (8A, 8B), and that the shell (8A, 8B) when its width as defined here makes up 60% and up to 100% of the vessel distance has been provided with or may have been provided with holes the function of which is to let water pass the shell (8A, 8B).

8. An apparatus according to any of the claims 2-7 in which apparatus the leading-to line for waste water contains a treatment device, c h a r a c t e r i z e d i n that this treatment device is a device (21) for mixing a precipitant into the waste water.

9. An apparatus according to any of the claims 2-7 in which apparatus the leading-to line for waste water contains a treatment device, c h a r a c t e r i z e d i n that this treatment device (22) is a device for mixing a pH adjusting agent into the waste water, preferably a device for mixing an alkaline material, such as lye.

10. An apparatus according to any of the claims 2-7 in which apparatus the leading-to line for waste water contains a treatment device, c h a r a c t e r i z e d i n that this treatment device is a device (23) for mixing pressurized water with a flocculating agent and for mixing the mixture of pressurized water and flocculating agent into the waste water.

11. An apparatus according to any of the claims 2-7 in which apparatus the leading-to line for waste water contains two treatment devices, c h a r a c t e r i z e d i n

(a) that the first treatment device (21) in the direction of flow of the waste water is a device for mixing a precipitant into the waste water and

(b) that the second treatment device in the direction of flow of the waste water is a device (23) for mixing pressurized water with a flocculating agent and for mixing the mixture of pressurized water and flocculating agent into the waste water.

12. An apparatus according to any of the claims 2-7 in which apparatus the leading-to line for waste water contains three treatment devices, c h a r a c t e r i z e d i n:

(a) that the first treatment device (21) in the direction of flow of the waste water is a device for mixing a precipitant into the waste water,

(b) that the second treatment device in the direction of flow of the waste water is a device (22) for mixing a pH adjusting agent into the waste water, preferably a device for mixing an alkaline material, such as lye, and

(c) that the third treatment device in the direction of flow of the waste water is a device (23) for mixing pressurized water with a flocculating agent and for mixing the mixture of pressurized water and flocculating agent into the waste water.

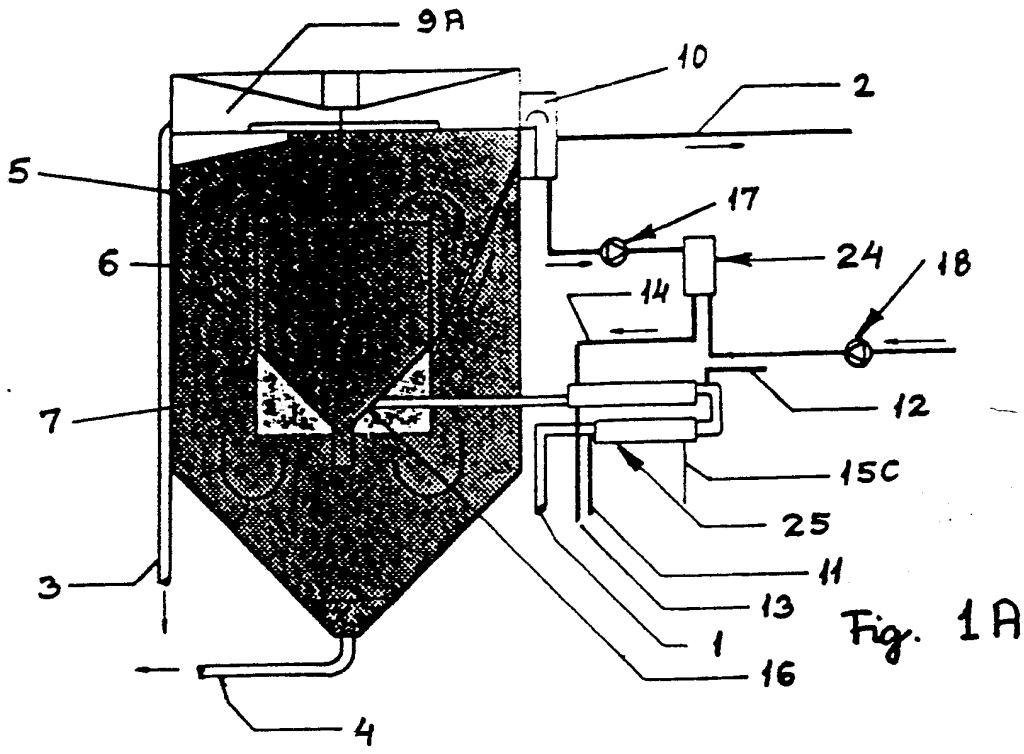


Fig. 1A

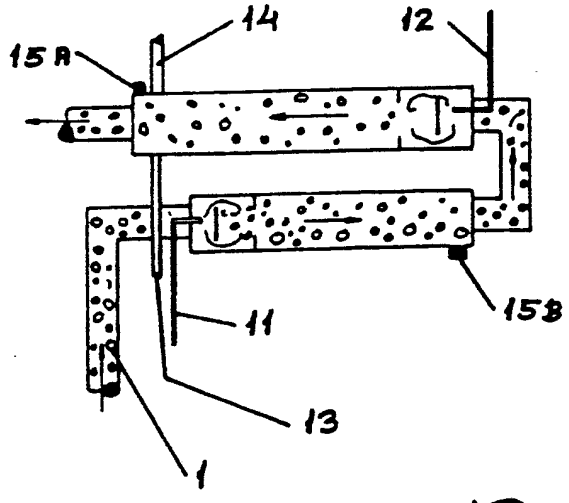
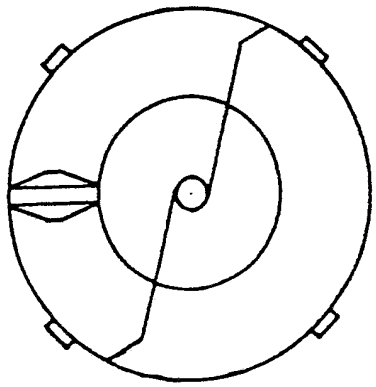


Fig. 1D

Fig. 1C



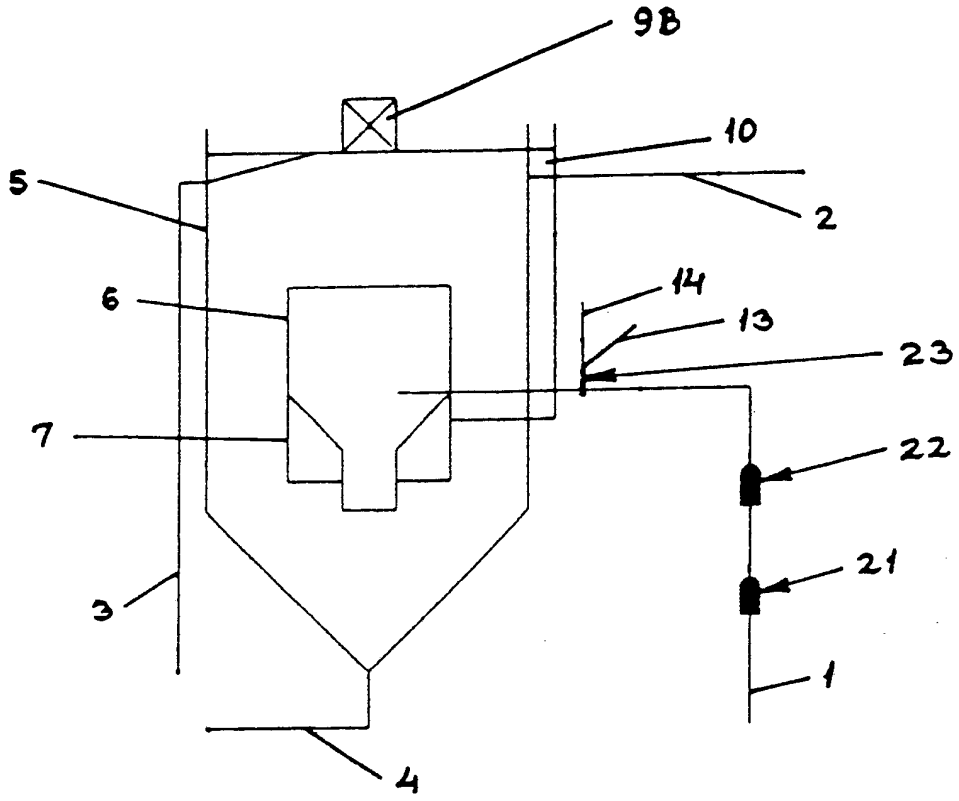


Fig. 1B

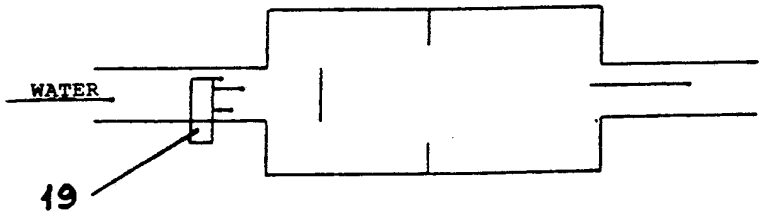


Fig. 4

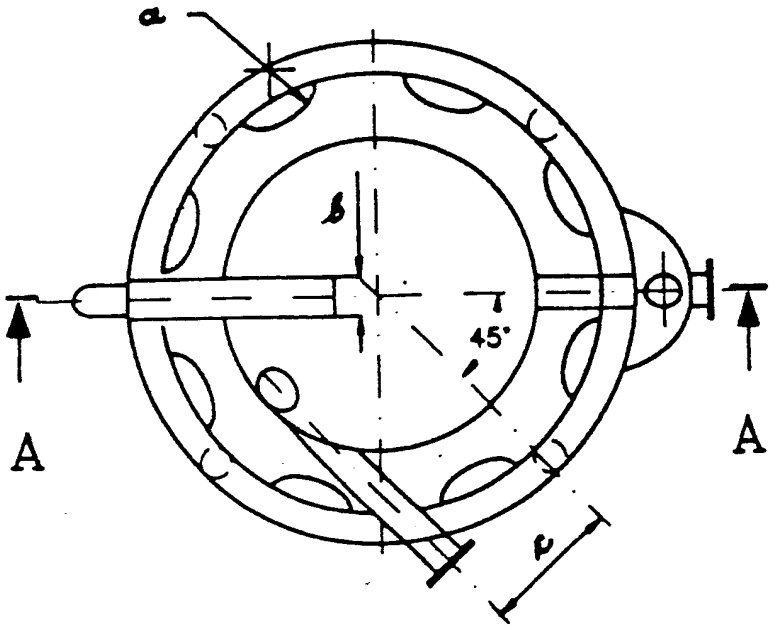

a
b
45°
A
A
c

Fig. 2

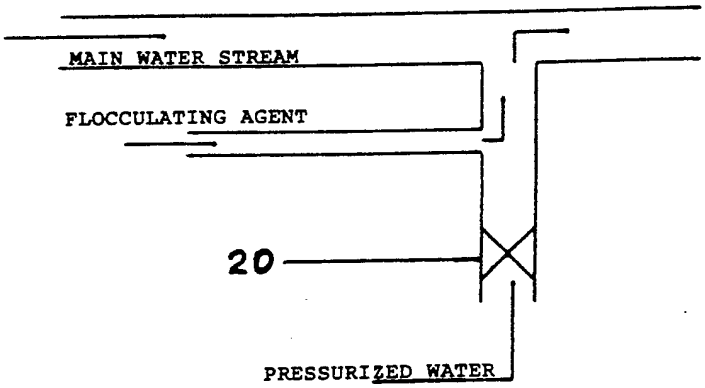

MAIN WATER STREAM
FLOCCULATING AGENT
20
PRESSURIZED WATER

Fig. 5

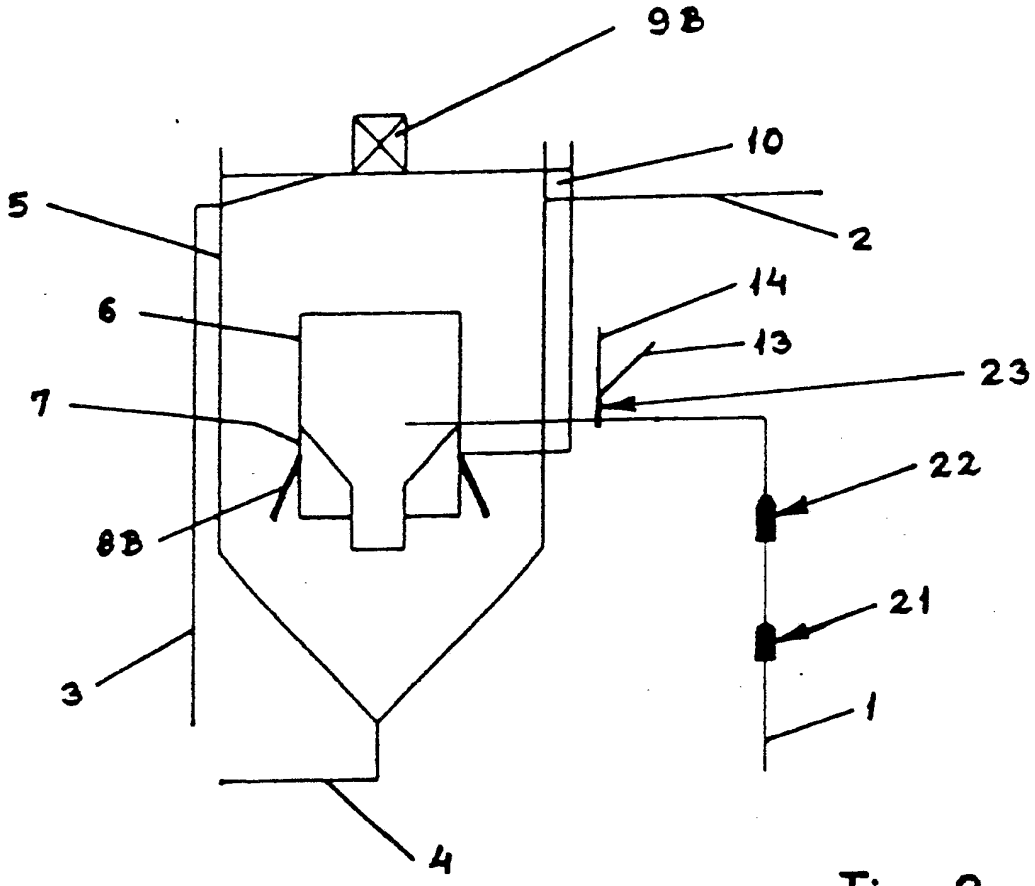

9B
10
5
2
14
6
13
23
7
22
8B
21
3
1
4

Fig. 3

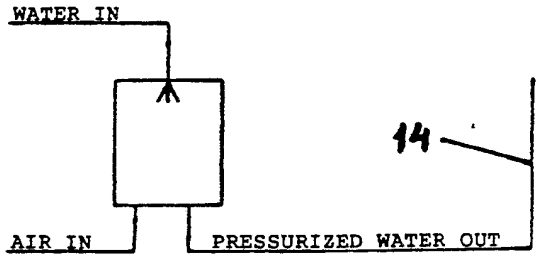

WATER IN
14
AIR IN
PRESSURIZED WATER OUT

Fig. 6

SECTION A - A

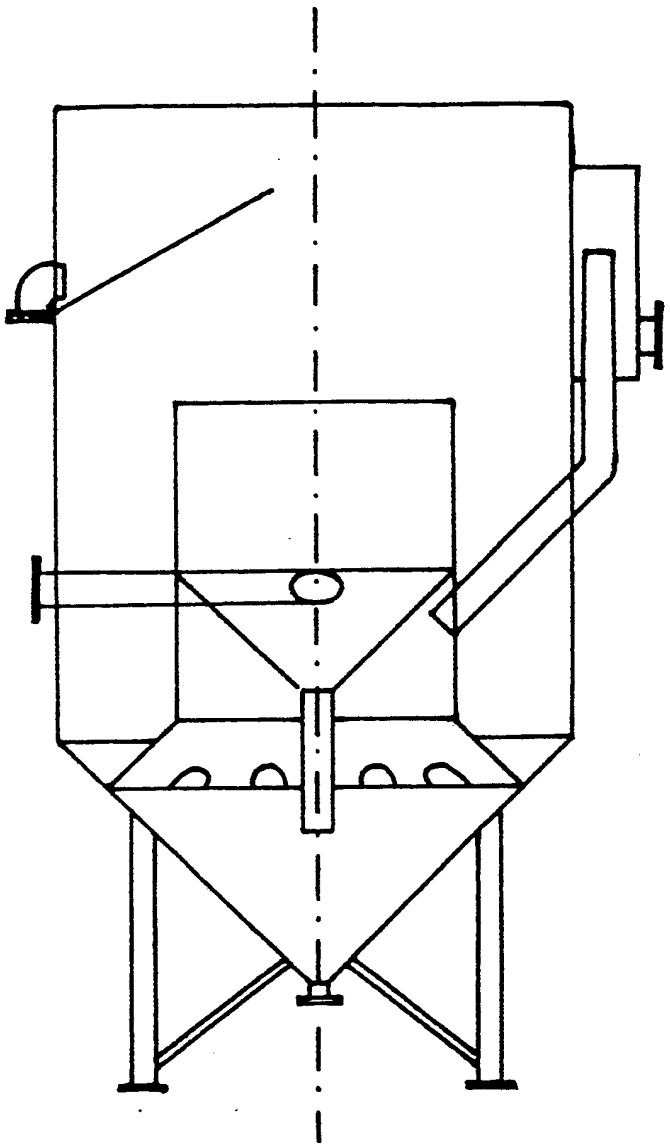


Fig. 7

INTERNATIONAL SEARCH REPORT

International Application No PCT/DK 90/00314

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC5: C 02 F 1/24

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
IPC5	B 01 D; B 03 D; C 02 F

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched[8]

SE,DK,FI,NO classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category *	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
A	US, A, 3642617 (EDWIN H. BRINK ET AL) 15 February 1972, see especially baffle 80 --	1,2
A	GB, A, 1459195 (PORTALS WATER TREATMENT) 22 December 1976, see the whole document --	1,4
A	DE, A, 2358077 (SAINT-GOBAIN TECHNIQUES NOUVELLES) 30 May 1974, see the whole document --	1
A	US, A, 3966598 (GREGORY A. ETTELT) 29 June 1976, see the whole document --	1

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
29th January 1991	1991 -02- 26
International Searching Authority	**Signature of Authorized Officer**
SWEDISH PATENT OFFICE	Johan Auby

Form PCT/ISA/210 (second sheet) (January 1985)

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
X	SE, C, 38196 (O. SCHMIDT) 25 April 1913, see the whole document --	1,2

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. PCT/DK 90/00314

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the Swedish Patent Office EDP file on 90-12-28
The Swedish Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 3642617	72-02-15	US-A- 3787316	74-01-22
GB-A- 1459195	76-12-22	NONE	
DE-A- 2358077	74-05-30	BE-A- 807615	74-05-21
		CH-A- 575781	76-05-31
		DE-C- 2366107	82-06-24
		FR-A-B- 2206985	74-06-14
		GB-A- 1427437	76-03-10
		JP-C- 1126941	82-12-14
		JP-A- 49135878	74-12-27
		JP-B- 57016872	82-04-07
		SE-B-C- 400761	78-04-10
US-A- 3966598	76-06-29	CA-A- 1046659	79-01-16
SE-C- 38196	13-04-25	NONE	

PUB-NO: WO009108175A1

DOCUMENT-IDENTIFIER: WO 9108175 A1

TITLE: SEWAGE PURIFICATION METHOD USING FLOTATION AND APPARATUS FOR THE IMPLEMENTATION OF THE METHOD

PUBN-DATE: June 13, 1991

INVENTOR-INFORMATION:

NAME	COUNTRY
KARSTEN, POULSEN	DK

ASSIGNEE-INFORMATION:

NAME	COUNTRY
AKVAGAD A S	DK

APPL-NO: DK09000314

APPL-DATE: December 3, 1990

PRIORITY-DATA: DK00610189A (December 4, 1989)

INT-CL (IPC): C02F001/24

EUR-CL (EPC): C02F001/24

US-CL-CURRENT: 210/200 , 210/512.1 , 210/703

ABSTRACT:

An improved and simplified purification of waste water making use of flotation and an apparatus therefor are described. The waste water may contain suspended particles having a density (almost) as the density of water. The purified liquid is led away from a region below the liquid surface and above the lower sludge take-off, preferably centrally in the outer vessel (5), and not over a saw-toothed edge. The apparatus may contain an outer and an inner vessel (5 and 6) where the outer vessel (6) may contain a bell (7) open at the bottom with upward directed leading-away canals for purified liquid. Possible downward directed shells (8A, 8B) between the vessel (5 and 6) further the purification of the liquid. The leading-to line (1) may have been introduced tangentially on the inner vessel (6). In the leading-to line there may be found specially worked out devices (21, 22 and 23) for pretreatment of the waste water. The purification and the use of the apparatus result in (much) purer led-away liquid than up to now, also in case of suspended particles having a density (almost) as the density of water.